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(54) Method of manufacturing a printed board fuse and a fuse produced by the method.

(57) In order to reduce the costs of assembled printed circuit boards, a printed board fuse (1) has been developed, which functions with great reliability at low manufacturing costs. By coating a large area of a printed board with metal, for example, by plating, a well-defined thickness of a metal layer (9) may be achieved in which a fuse (3) has been separated. The well-defined thickness also allows well-defined geometry of the fuse cross-sectional area and fuse length to be achieved and therefore its resistance and interruption characteristics will also be very accurately defined. In case of a temperature rise, the metal layer (9) surrounding the fuse (3) will have a heat dissipating effect on the fuse, implying an essentially reduced risk of board fire.

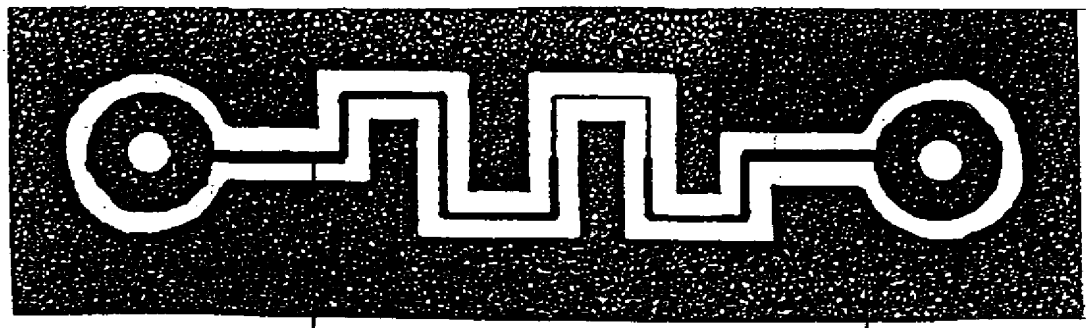

fig. 2A

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Technical field

The present invention relates to a method and a device for protecting a printed board against overcurrents by mounting thereon a printed board fuse which will interrupt the current in case of overcurrents.

Prior art

From, for example, EP-A1 0 270 954 there is previously known a chip-type fuse which may be used mounted on and connected to a printed circuit board/printed board. Said chip-type fuse comprises an insulating member, such as an insulating substrate having a pair of metallic electrodes of thin-film type disposed thereon, between which a current sensitive conductor is connected. Should an overcurrent pass through the fuse, the conductor will melt and the current will be interrupted. In order to prevent, in case of the conductor melting because of an overcurrent, a generated metal vapour from being set free and spreading and also to prevent arc discharge, the conductor is coated with a protective silicone resin film. Despite the small size of the fuse, the insulating member/substrate permits high current intensities. For increased sensitivity, the chip-type fuse may optionally be provided with trimmed portions which would more easily melt in case of an overcurrent.

From FR-A 2 053 881 there is previously known a similar fuse for printed circuits/printed boards. It is made according to the technique for printed circuits or rather by means of a method for analogue circuits such as metal coating, electroplating or attachment of a metallic film. The fuse is characterized in that the conductive current sensitive circuit contains a plurality of spaced apart constricted areas adjacent extended conductive surfaces. In the case of a temperature rise in the constricted areas, the substrate will not be affected since the constricted areas are located adjacent the extended conductive surfaces, which are exposed to the air so that the heat may be dissipated.

Summary of the invention

In order to reduce the costs of printed board assemblies, a printed board fuse has been developed which functions with great reliability at very low manufacturing costs. By coating a large area of a printed board with metal, for example electrolytically, a well-defined thickness of a metal layer may be achieved in which a fuse of, for example, square-wave type has been separated. The well-defined thickness also allows a well-defined geometry of the printed board fuse to be achieved. A prerequisite for a well functioning fuse, which works in a similar way on boards with different layouts, is that the cross-sectional area and length of the printed board fuse and therefore its resistance are very accurately defined. This is achieved by the metal layer surrounding the fuse and in case of a temperature rise said surrounding metal layer will have a heat dissipating effect on the fuse, implying an essentially reduced risk of board fire.

Description of the drawings

Fig. 1 shows a printed board having printed board fuses according to the invention,

Fig. 2A shows a printed board fuse with copper plane according to the invention, on an enlarged scale, and

Fig. 2B shows a portion of the printed board fuse according to the invention, with indicated measures.

Description of an embodiment

For boards containing a large number of components, pattern plating is the most widely used manufacturing method. It is based on the principle of additively building up a pattern, in contrast to the tenting method in which a pattern is formed by etching. The pattern plating method has its limitations as regards thickness distribution. A variation is often due to the pattern distribution of the layout. Depending on the pattern distribution, the current from rectifiers in a plating bath will be distributed over the surface not protected by photoresist. Insulated conductors without surrounding copper will have a higher current density (A/dm^2) than a conductor located in an area with a large quantity of copper. The current density will determine the rate of precipitation of copper, and the time will determine the thickness. If there is no balanced shape, there may be great differences between different parts of a board. By applying the present plating method on the layout according to the invention there will be very small variations in the thickness of the copper plating and it is possible to achieve a very well defined thickness of individual elements.

By using, for instance, a plating method on a printed board, a fuse of copper may be provided as a conductor with very well defined shape and cross-sectional area, and a surrounding area with a uniform and well defined coated copper layer may be achieved. Since the fuse and the surrounding copper layer are made to cover a relatively large area with almost homogenous copper on the printed board, said method makes it possible to predetermine a certain thickness of the copper layer and therefore of the fuse, implying known interruption characteristics. The difference in thickness of one and the same conductor in a fuse with or without surrounding copper plane may amount to as much as 50% depending on the layout of the board, which would essentially alter the interruption characteristics.

Fig. 1 shows a plurality of printed board fuses disposed in a row along one longitudinal side of a printed

board 2. Fig. 2 shows a possible configuration of a printed board fuse 1 on said board. Measurements for circuits of this kind are indicated as follows: 1 mil = 0,0254 mm, and 1 M = 2,54 mm. The individual conductor 3 of the fuse 1 is shaped like a square wave and could be described as a "snake". The length 4 of the fuse or "snake" could be 4 M, where the length of each edge portion 5 is 1 M and the distance 6 between the edges is 1 M. The width 7 of a surrounding copper plane could be 3 M. The width of the conductor 3 to and from the fuse is, for example, 8 mils, while the width of a shorter portion of the fuse, a section 8, is 6 mils in order to provide a defined interruption point for an overcurrent. The distance between the copper plane 9 and the conductor of the fuse could be 8 mils. The thickness of the fuse could be 40 µm, which is obtainable by said shape and method.

While only one shape of the fuse has been described, other shapes of the invention are feasible, in which a well-defined thickness of the conductor and a separate copper plane surrounding the conductor is achievable. The printed board is typically coated with a lacquer layer. In order for the fuse to have an increased heat dissipating capacity, the fuse may optionally be provided with an underlying insulated metallic plane of, for example, copper.

Claims

1 A method for manufacturing a printed board fuse to protect a printed board against overcurrents, characterized in that a metal layer is coated on an area of a printed board in which one or several conductors are individually separated, whereby a well-defined thickness of the conductor and of a heat dissipating metal surface separate from and surrounding the conductor(s) is provided.

2 A method according to claim 1, characterized in that a copper layer is deposited by plating in which one or several conductors are individually separated, whereby a well-defined thickness of the conductor and of a heat dissipating copper surface separate from and surrounding the conductor(s) is provided.

3 A printed board fuse for protecting a printed board against overcurrents, characterized in that the fuse consists of a metallic conductor (3) of well-defined shape and thickness, which conductor is separated from a coated metal layer and separately surrounded by a metal surface (9) formed by the metal layer and that the fuse is placed alone on the printed board (2) or that a plurality of fuses are placed thereon.

4 A printed board fuse according to claim 3, characterized in that the fuse provided by plating consists of a conductor (3) of copper of well-defined shape and thickness separated from a coated copper layer and separately surrounded by a copper surface (9) formed by the copper layer and that the fuse is placed alone on the printed board (2) or that a plurality of fuses are placed thereon.

5 A printed board fuse according to claim 3 or 4 characterized in that the fuse is of square-wave shape and has a section (8) of reduced width.

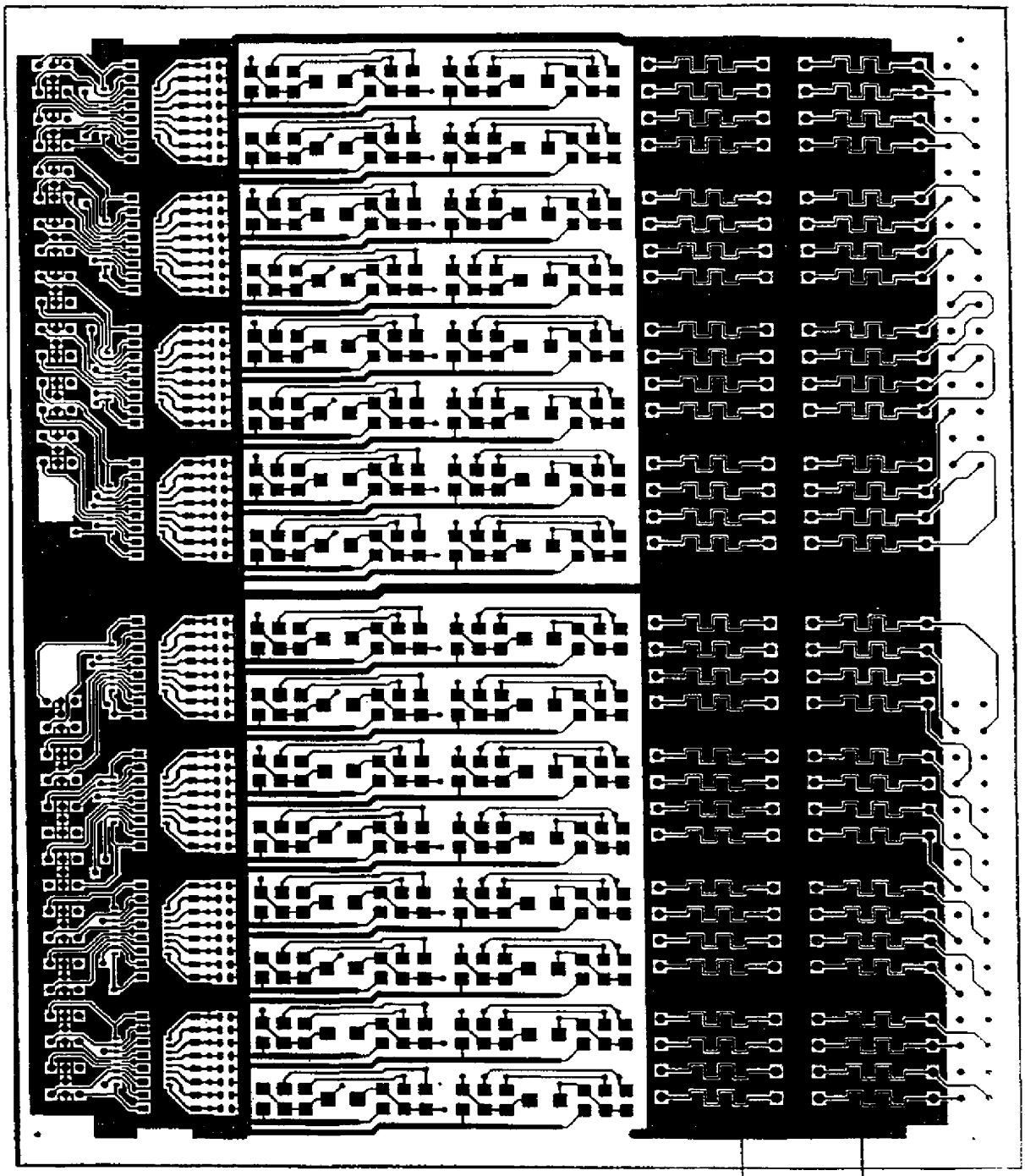

fig. 1

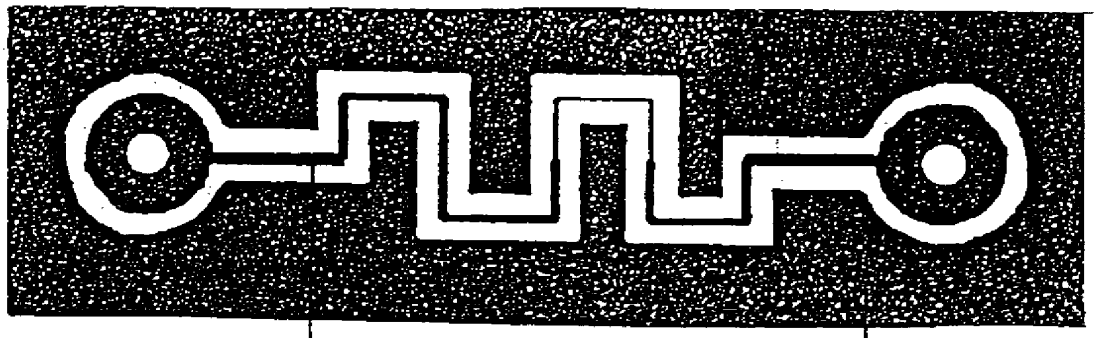

fig. 2A

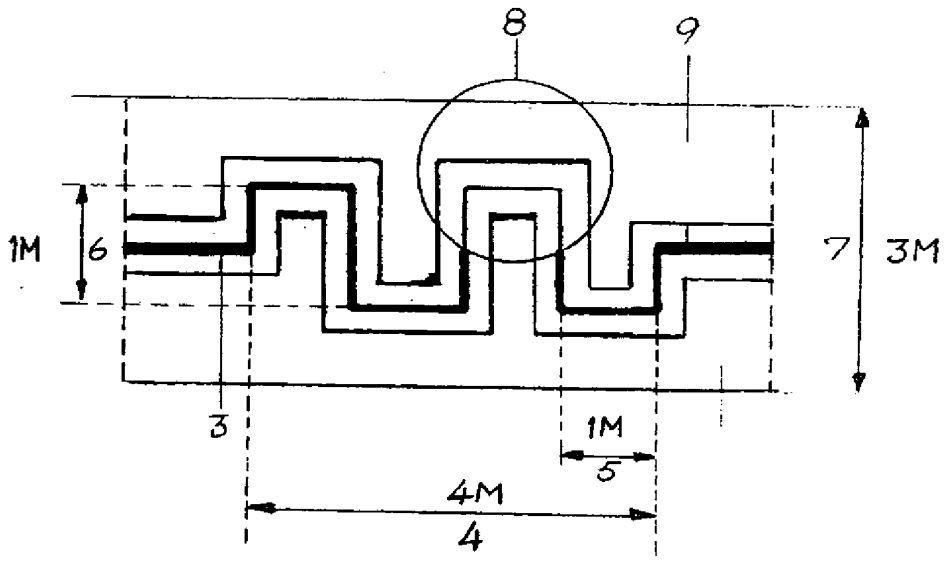

fig. 2B

European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 94 85 0094

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.5)
A	US-A-4 356 627 (NORMAN E. HOFFMAN) * column 5, line 8 - line 29; figures 1,3,4 *	1-4	H01H85/046 H05K1/16
A	US-A-4 788 626 (ARNO NEIDIG ET AL.) * column 5, line 23 - line 49; figures 1,2 *	1-4	
A,D	EP-A-0 270 954 (OMRON TATEISI ELECTRONICS CO.) * column 3, line 19 - line 39; figure 3 *	5	
A,D	FR-A-2 053 881 (JEAN AVRIL) * the whole document *	1-4	

TECHNICAL FIELDS SEARCHED (Int.Cl.5)
H01H H05K

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
STOCKHOLM	23 August 1994	BERTIL NORDENBERG

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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